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Gravitational perturbations in the expanding universe in a coordinate representation

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Abstract

Gravitational perturbations in the expanding universe are analyzed within the framework of Newtonian cosmology. In contrast to classical work, the perturbations are found not in a Fourier but in a coordinate representation. This makes it possible to obtain general expressions for finding the distributions of perturbations in the density and velocity of matter as a function of the coordinates and time from the known distribution at the initial time. In the simplest cases of plane-symmetric and spherically symmetric distributions, analytical equations are obtained for density perturbations as a function of the coordinates and time. The final conclusion is that it is possible for gravitational perturbations to grow even when the characteristic size of a perturbation is less than the Jeans wavelength.